

WHAT IS CLAIMED IS:

1. A detecting apparatus comprising:

a plurality of signal generating devices each generating a signal whose magnitude varies periodically in accordance with a positional change of a rotating shaft, which is a base for rotation of a rotating body and whose position is offset when force is applied thereto, and in accordance with a rotational state of the rotating body, the signal generating devices being disposed at predetermined positions such that phases of the generated signals are different;

a characteristic amount detecting device detecting a characteristic amount corresponding to an amount of positional offset of the rotating shaft, on the basis of the signals generated by the plurality of signal generating devices; and

a moment detecting device detecting a moment applied to the rotating shaft on the basis of the characteristic amount detected by the detecting device, and on the basis of a relationship which is determined in advance on the basis of a shaft stiffness of the rotating shaft and the characteristic amount which varies in accordance with the positional offset of the rotating shaft.

2. The detecting apparatus of claim 1, further comprising a pulse generating device generating pulses, whose periods correspond to a rotational angle of the rotating body and the positional offset

of the rotating shaft, from the signals generated by the plurality of signal generating devices,

wherein the characteristic amount detecting device detects the characteristic amount from the pulses generated by the pulse generating device.

3. The detecting apparatus of claim 2, wherein the characteristic amount detecting device is structured by:

a speed change rate computing device determining a speed change rate for each pulse of the rotating body accompanying a positional change of the rotating shaft, from the period of each pulse generated by the pulse generating device during one period of the rotating body, and an average value of a rotational speed of the rotating body during one period of the rotating body; and

a higher-order component computing device detecting, as the characteristic amount, a predetermined higher-order component of the determined speed change rate of the rotating body.

4. The detecting apparatus of claim 1, wherein the signal generating devices generate the signals on the basis of variations in magnetic flux between a fixed element and a rotating element which rotates together with the rotating body.

5. The detecting apparatus of claim 1, wherein the characteristic amount detecting device detects, as the characteristic amount,

an amount which is dependent on a phase difference of the signals generated by the plurality of signal generating devices.

6. The detecting apparatus of claim 5, wherein the characteristic amount detecting device detects, as the characteristic amount, an amount of offset of a signal generated by calculating a product of the signals generated by the plurality of signal generating devices.

7. The detecting apparatus of claim 1, wherein the characteristic amount detecting device detects, as the characteristic amount, an amount which is dependent on an amplitude of a signal generated by calculating a difference between the signals generated by the plurality of signal generating devices.

8. The detecting apparatus of claim 1, further comprising:

    a rotational angle detecting device detecting a rotational angle of the rotating body; and

    an amplitude detecting device determining amplitudes of the plurality of signals generated by the plurality of signal generating devices,

    wherein, on the basis of the angle detected by the rotational angle detecting device, the characteristic amount detecting device detects, as the characteristic amounts, amplitudes of the plurality of signals determined by the amplitude detecting device

when the rotational angle is a predetermined angle.

9. The detecting apparatus of claim 8, wherein the predetermined angle is an angle which is within a predetermined range which includes a rotational angle which is considered to be a rotational angle of the rotating body at which the amplitudes of the plurality of signals determined by the amplitude detecting device become maximums.

10. The detecting apparatus of claim 9, wherein the predetermined angle is the rotational angle which is considered to be the rotational angle of the rotating body at which the amplitudes of the plurality of signals become maximums, and is

$$(\pi/4) + n \cdot (\pi/2)$$

where n is an integer of 0 or more.

11. The detecting apparatus of claim 1, wherein the shaft stiffness of the rotating shaft is a moment applied to the rotating shaft.

12. A detecting apparatus comprising:

a plurality of signal generating devices each generating a signal whose magnitude varies periodically in accordance with a positional change of a rotating shaft, which is a base for rotation of a tire mounted to a vehicle and whose position is offset when

force is applied thereto, and in accordance with a rotational state of the tire, the signal generating devices being disposed at predetermined positions such that phases of the generated signals are different;

a characteristic amount detecting device detecting a characteristic amount corresponding to an amount of positional offset of the rotating shaft, on the basis of the signals generated by the plurality of signal generating devices; and

a tire generated force detecting device detecting a tire generated force generated between the tire and a road surface, on the basis of information regarding mechanisms of the tire, and on the basis of the characteristic amount detected by the characteristic amount detecting device, and on the basis of a relationship which is determined in advance on the basis of a shaft stiffness of the rotating shaft and the characteristic amount which varies in accordance with the positional change of the rotating shaft.

13. A detecting apparatus comprising:

a plurality of signal generating devices each generating a signal whose magnitude varies periodically in accordance with a positional change of a rotating shaft, which is a base for rotation of a tire mounted to a vehicle and whose position is offset when force is applied thereto, and in accordance with a rotational state of the tire, the signal generating devices being disposed

at predetermined positions such that phases of the generated signals are different;

a rotational angle detecting device detecting a rotational angle of the tire;

an amplitude detecting device determining amplitudes of the plurality of signals generated by the plurality of signal generating devices;

a detecting device detecting, on the basis of the angle detected by the rotational angle detecting device and the amplitudes of the plurality of signals detected by the amplitude detecting device, a difference between a rotational angle of the tire at which the amplitudes of the plurality of signals become maximums and a rotational angle which is considered to be a rotational angle of the tire at which the amplitudes of the plurality of signals become maximums, and the peaks of the amplitudes of the plurality of signals; and

a moment detecting device detecting a moment around an imaginary axis which exists within a plane which is perpendicular to the rotating shaft of the tire, on the basis of the difference in the rotational angles and the peaks which were detected by the detecting device.

14. A detecting apparatus comprising:

a pair of signal generating devices each generating a signal whose magnitude varies periodically in accordance with a

positional change of a rotating shaft, which is a base for rotation of a tire mounted to a vehicle and whose position is offset when force is applied thereto, and in accordance with a rotational state of the tire, the signal generating devices being disposed at predetermined positions such that phases of the generated signals are different, and being disposed at positions which are offset from one another by a tire rotational angle of  $180^{\circ}$ , and being disposed at positions which are symmetrical with respect to an imaginary axis in a vertical direction of the tire;

a detecting device detecting a difference between the signals generated by the pair of signal generating devices; and

a moment detecting device detecting a moment around an imaginary axis which exists within a plane which is perpendicular to the rotating shaft of the tire, on the basis of the difference between the signals generated by the pair of signal generating devices which difference was detected by the detecting device.

15. A detecting apparatus comprising:

a pair of signal generating devices each generating a signal whose magnitude varies periodically in accordance with a positional change of a rotating shaft, which is a base for rotation of a tire mounted to a vehicle and whose position is offset when force is applied thereto, and in accordance with a rotational state of the tire, the signal generating devices being disposed on an imaginary axis in a tire vertical direction at positions

which are offset from one another by a tire rotational angle of 180°;

a detecting device detecting a difference between the signals generated by the pair of signal generating devices; and

a moment detecting device detecting a moment around an imaginary axis in a horizontal direction of the tire, on the basis of the difference between the signals generated by the pair of signal generating devices which difference was detected by the detecting device.

16. A detecting apparatus comprising:

a plurality of signal generating devices each generating a signal whose magnitude varies periodically in accordance with a positional change of a rotating shaft, which is a base for rotation of a rotating body attached to a vehicle and whose position is offset when force is applied thereto, and in accordance with a rotational state of the rotating body, the signal generating devices being disposed at predetermined positions such that phases of the generated signals differ when a positional change of the rotating shaft arises;

a detecting device detecting a phase difference of the signals generated by the signal generating devices; and

a moment detecting device detecting a moment applied to the rotating shaft, on the basis of the phase difference detected by the detecting device.



17. A detecting apparatus comprising:

a plurality of signal generating devices each generating a signal whose magnitude varies periodically in accordance with a positional change of a rotating shaft, which is a base for rotation of a tire mounted to a vehicle and whose position is offset when force is applied thereto, and in accordance with a rotational state of the tire, the signal generating devices being disposed at predetermined positions such that phases of the generated signals differ when a positional change of the rotating shaft arises;

a detecting device detecting a phase difference of the signals generated by the signal generating devices; and

a moment detecting device detecting a moment around an imaginary axis which exists within a plane which is perpendicular to the rotating shaft of the tire, on the basis of the phase difference detected by the detecting device; and

a tire generated force detecting device detecting a tire generated force on the basis of the moment detected by the moment detecting device.